slowed down the motion of the drop. Illuminating the drop from the opposite side definitely changed the direction of motion. The red and infrared radiation was then filtered out by a 2 cm layer of a solution[2] known to pass about 25 per cent. of the visible light. The motion stopped completely within 40 seconds and started again as soon as the filter was removed. When the total intensity of the beam was reduced to 25 per cent. by halving the diameter of a variable diaphragm, the motion slowed down, but did not stop.

From the above results, we can conclude (*a*) that a magnetic field is not necessary for the production of this particular "rotation," (*b*) that this effect is due to the heat radiation of the illuminating light which causes convection currents in the drop (the center being maintained at a higher temperature than the lateral surface, at which evaporation takes place).

No inferences should be drawn from these conclusions as to any other kind of rotation, either in liquids or gases. Further experimental work on these will be published later.

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## WHY THE HALO AND THE CORONA DO NOT APPEAR IN THE SAME CLOUD

As explained in any work on atmospheric optics, the halo, of which the most common of its several forms is the rainbow-tinted circle of 22° radius (the full moon subtends half a degree) around the sun or moon, is caused by snow crystals in the air; and the corona, a rather brightly colored ring (sometimes, two —rarely three—concentric rings) usually of two to four degrees radius, about the sun or moon, by tiny water drops.

Both these phenomena, the large halo and the much smaller corona, are often seen in thin clouds (thick clouds scatter the light too much for the rings to remain conspicuous) but never both in the same cloud.

Clearly, then, an intermingling of water droplets, essential to the corona, and ice crystals, necesssary for a halo, can not persist in the air. And this, in turn, is owing to the fact that at every temperature below the freezing point the tendency of water droplets (undercooled, of course) to evaporate is greater than that of ice crystals at the same temperature. The ice crystals, therefore, in a cloud of crystals and droplets, if such a cloud could and did occur, would grow at the expense of the droplets, which quickly would disappear.

At temperatures above the freezing point, snow crystals obviously can not exist, nor, as above explained, can water droplets and snow crystals persist mingled together at temperatures below the freezing point, and even at the freezing point, when the vapor tension over a flat surface of pure water is the same as that over ice, the droplet, owing to an effect of surface tension, still evaporates over to the crystal. Hence, an intermingling of water droplets and ice crystals can not persist at any temperature. Hence, the halo and the corona never appear simultaneously in the same cloud.

In this connection it is interesting to note that, according to tables in Dorsey's "Properties of the Ordinary Water Substance," the difference between the vapor tension of water and that of ice at the same temperature has its maximum value, an amount sufficient to sustain a 0.2 mm column of mercury or equal to a pressure of five pounds per square yard, at around 10° F., a common temperature of the air at halo levels.

W. J. HUMPHREYS

# SCIENTIFIC BOOKS

## ALGEBRA AND TRIGONOMETRY

*College Algebra and Trigonometry, A basic integrated course.* xii + 324 pp. By FREDERIC H. MILLER. John Wiley and Sons. 1945. $3.00.

MANY colleges require a year of college algebra and trigonometry as preparation for subsequent study of analytic geometry and the calculus. Some of these colleges may prefer that this college algebra and this trigonometry be intimately merged in some significant way. If so, they will wish to give careful consideration to Mr. Miller's new book.

The reviewer has little interest in a merger of this sort; and, although convinced that much unhappiness in analytic geometry and the calculus is attributable to a poor grasp of algebra, he sees no reason to insist —as so many colleges do insist—that analytic geometry and the calculus shall be withheld until the student shall have acquired so wide an acquaintance with algebra or so rigorous a training in it as this book demands. Nevertheless, the reviewer does have an interest to see that every program, whether traditional or novel—and Mr. Miller's program is a mixture of both—shall have a fair chance to prove its worth; and no program can have this chance until embodied

[2] Handbuch der Physik, Vol. XIX, "Herstellung und Messung des Lichts." Berlin, Julius Springer, publisher, 1928.